

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Bernhard SCHEUBLE *et al.* :
Serial No.: : Group Art Unit: 2871
Filed: July 23, 2001 : Examiner: T. Duong
For: ELECTROOPTICAL SYSTEM

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

SIR:

Prior to examination of the above-identified application, please amend the application as follows:

IN THE SPECIFICATION

Please replace pages 1-37 with the substitute specification attached hereto.

IN THE CLAIMS

Please cancel claims 2-14 and replace them with new claims 15-33 as follows:

- 15. An electrooptical system containing:
- (a) a twisted nematic liquid-crystal layer, with an input side and an output side, which is positioned between a first substrate and a second substrate, each of whose inside surface is provided with an electrode coating and an alignment layer thereon, the director of said liquid crystal layer having a parallel edge alignment and a twist angle of $0^\circ \leq \beta \leq 60^\circ$ or a homeotropic edge alignment, and
 - (b) at least one device for linear polarization of light in such an arrangement that light, before entering and after exiting the liquid-crystal layer, passes through a polarization device,

I. wherein, in order to achieve high contrast, and/or high brightness, and/or high viewing angle independence of the contrast and/or the color values, the angle ψ , which the polarization device on the input side of the liquid crystal layer forms with the director of the liquid-crystal molecules on the surface of the first substrate, satisfies

I.A. condition (1) or (2)

$$\psi = (\beta + 90^\circ)/2 \pm 10^\circ \quad (1)$$

$$\psi = \beta/2 \pm 10^\circ \quad (2)$$

where a polarization device is present on both the light input side of the liquid crystal layer and the light output side of the liquid crystal layer, and the polarization device on the output side of the liquid crystal layer is rotated by 90 ± 10 with respect to the polarization device on the input side of the liquid crystal layer, and, optionally, alignment of the polarization devices on the input side and the output side of the liquid crystal layer are interchanged, or satisfies

I.B. condition (3) or (4)

$$30 \leq \psi \leq 70^\circ \text{ for } 0 \leq \beta \leq 45^\circ \quad (3)$$

$$35 \leq \psi \leq 90^\circ \text{ for } 45 \leq \beta \leq 60^\circ \quad (4),$$

where a polarization device is only present on the input side.

16. A system according to claim 15, wherein the electrooptical system further contains one or more compensation layers for compensating the optical path difference of the liquid-crystal layer $d \cdot \Delta n$

I. wherein the compensation layer comprises a material having three optical refractive indices, of which one is less than the other two, and wherein the optical axis corresponding to this lowest refractive index is essentially parallel to the surface of said second substrate or forms an angle of $2^\circ < \gamma < 60^\circ$ with the surface of said second substrate, as a result of which, the angle between the optical axis of the compensation layer and the optical axis of the liquid-crystal layer, upon application of a voltage, passes through a minimum, and

II. wherein the plane set up by the two other refractive indices forms an angle of between 30° and 150° with the director of the liquid-crystal at the surface of the second substrate.

17. A system according to claim 15, wherein the system further contains a birefringent layer.

18. A system according to claim 15, wherein the twist angle β is $0 \leq \beta \leq 45^\circ$.
19. A system according to claim 15, wherein the twist angle β is $0 \leq \beta \leq 15^\circ$.
20. A system according to claim 15, wherein the twist angle β is $0 \leq \beta \leq 5^\circ$.
21. A system according to claim 15, wherein the twist angle β is essentially 0° .
22. A system according to claim 15, wherein the optical retardation $d \cdot \Delta n$ of the liquid crystal layer is $\leq 0.40 \mu\text{m}$.
23. A system according to claim 15, wherein the optical retardation $d \cdot \Delta n$ of the liquid crystal layer is $\leq 0.30 \mu\text{m}$.
24. A system according to claim 15, wherein the optical retardation $d \cdot \Delta n$ of the liquid crystal layer is essentially $0.28 \mu\text{m}$.
25. A system according to claim 15, wherein the Δn of the liquid crystal is ≤ 0.0735 .
26. A system according to claim 15, wherein the Δn of the liquid crystal satisfies the relationship $0.035 \leq \Delta n \leq 0.065$.
27. A system according to claim 15, wherein the Δn of the liquid crystal is ≤ 0.056 .
28. A projection device containing a system according to Claim 15.
29. System according to claim 16, characterized in that the compensation layer is based on a thermoplastic polymer, a low-molecular-weight liquid crystal and/or a liquid-crystalline polymer.

30. System according to claim 16, containing a liquid-crystal layer which has a homeotropic edge alignment, characterized in that the compensation layer is based on a material having 3 optical refractive indices, of which one is lower than the other two, the axis corresponding to this lower refractive index being essentially perpendicular to the electrode surfaces.

31. System according to claim 15, characterized in that the system contains only one polarization device and at least one reflector.

32. Electrooptical system containing

- a liquid-crystal layer of negative dielectric anisotropy between two substrates whose insides are provided with electrode coatings and alignment layers thereon, the liquid crystal having a homeotropic edge alignment, and
- at least one device for linear polarisation of the light in such an arrangement that the light, before entering and after exiting the liquid-crystal layer, passes through a polarisation device, at least once in each case,

characterized in that the liquid crystal has a twist angle of $0 < \beta \leq 60^\circ$.

33. Electrooptical system containing

- a twisted nematic liquid-crystal layer between 2 substrates whose insides are provided with electrode coatings and alignment layers thereon, the liquid crystal having a homeotropic edge alignment,
- if desired one or more layers for compensating the optical path difference of the liquid-crystal layer, and
- at least one device for linear polarisation of the light in such an arrangement that the light, before entering and after exiting the liquid-crystal layer, passes through a polarisation device at least once in each case,

characterized in that the liquid crystal has a twistangle of $0^\circ \leq \beta \leq 60^\circ$ and, in order to improve the viewing angle dependence of the contrast, has an optical path difference $d \cdot \Delta n$ of $\leq 0.40 \mu\text{m}$.

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REMARKS

The specification in the parent application was substituted at the request of the Examiner.

The specification filed herein has been substituted with the same documents.

Support for claims 15-33 is within the specification identified below:

Claim 15 - page 18, lines 18-20.

Claim 16 - conforms to original claim 4.

Claim 17 - Background.

Claims 18-20 - page 18, line 24.

Claim 21 - page 17, line 2.

Claims 22-24 - page 26, line 8.

Claim 25 - page 12, line 22.

Claim 26 - page 21, lines 17-18.

Claim 27 - page 25, line 38.

Claim 28 - conforms to original claim 13.

Claim 29 - conforms to original claim 2.

Claim 30 - conforms to original claim 5.

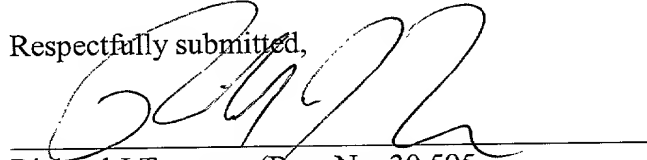
Claim 31 - conforms to original claim 8.

Claims 32 - conforms to original claim 9.

Claim 33 - conforms to original claim 11.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages are captioned **"Version with Markings to Show Changes Made"**.

Respectfully submitted,



Richard J. Traverso (Reg. No. 30,595)
Attorney for Applicants

MILLEN, WHITE, ZELANO & BRANIGAN, P.C.
Arlington Courthouse Plaza I
2200 Clarendon, Suite 1400
Arlington, VA 22201
(703) 812-5310
Internet address: traverso@mwzb.com

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